

Science targets coal impact

BYU professor working to reduce carbon footprint and warming

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Brigham Young University scientist Larry Baxter concedes that carbon sequestration will make electricity more expensive and power plants less efficient. Yet because of global warming concerns, the technology may be required. If it is, he may have developed better sequestration technology.

In addition, he and his team at the Provo university have improved coal gasification techniques, another way to reduce humanity's carbon footprint. A professor of chemical engineering at BYU, he earlier worked with Sandia National Laboratories.

Interest in both sequestration and coal gasification stems from concern about global warming. Burning carbon fossil fuels, particularly coal, releases a tremendous amount of carbon dioxide pollution, the "greenhouse gas" most blamed for global warming. Also, the pollution itself is harmful, with or without warming.

According to Baxter's calculations, as posted on one of his Web pages at BYU, electrical power generation is responsible for about one-third of the total carbon dioxide released in the U.S. and coal produces more than 80 percent of the CO₂ released by power generation. About 1 billion tons of coal are burned every year by 1,200 power plants, his site adds.

Two of the most promising ideas about stemming the flood of CO₂ emissions are carbon sequestration and coal gasification.

Carbon sequestration

The idea is to remove carbon dioxide from the gas streams of power plants and other stationary sources before they can escape into the atmosphere. Sequestration envisions safely disposing of CO₂; some suggestions for disposal involve pumping the gas under pressure into geological formations deep underground.

Sequestration necessarily reduces plant efficiency and increases the cost of electricity.

Removing carbon dioxide under current known systems would cut plant capacity by 25 percent to 30 percent, Baxter said in a telephone interview.

Besides the plant's loss in efficiency, more costs would come from investing in the technology.

Baxter estimated that the cost to build a new coal-fired power plant with today's technology would raise the cost of electricity to 6 cents per generated kilowatt-hour. (Rocky Mountain Power, using plants that were constructed during periods of lower inflation, produces electricity at about 3.5 cents per generated kilowatt-hour.)

If the currently-envisioned sequestration technology is added, the expense of the equipment would increase the cost of power from a new plant to 11 cents per generated kilowatt-hour, he said. Power bills would skyrocket faster than recent jumps in the price of gasoline.

But when Baxter was on leave in Denmark, researching at a power plant there, he came up with a new method to achieve carbon sequestration. He has not yet found a name for it but has filed requests for patents. He plans to market it through a company tentatively named Sustainable Energy Solutions.

Although expensive, the technique would be "less expensive and more energy-efficient," he said.

With his method, sequestration would limit a power plant's efficiency drop to about 15 percent, rather than 25 percent or 30 percent, meaning fewer tons of coal would be burned per megawatt of electricity. Also, it's less expensive to install the technology, so a new power plant using the technique could produce electricity at 8 cents per kilowatt-hour of generated power, compared with 11 cents.

Experts from Denmark happened to be due to visit his home the day of the interview, checking into the new technology.

"What we would hope to do is license it to people who would build it," Baxter said. "It's a type of process that costs literally hundreds of millions of dollars to put in place."

Coal gasification

This is a system whose time may have come, Baxter said. It may finally be feasible from a commercial standpoint.

In gasification, coal is broken down into hydrogen, water, waste products, carbon dioxide and carbon monoxide. Clean components can be burned for power and the pollution more easily controlled.

Coal gasification has been around for decades, he noted. It was used by Germany during World War II when the Allies cut off oil supplies. But other than extreme situations like that, he said, gasification has not been commercially viable.

That is, not until now. Not only has Baxter been working on better techniques in his BYU lab, but global warming fears may have made coal gasification worth the investment.

In experiments, the team found that the cost of separating the usable organic components of coal is only one of the expenses. Another part of the cost is dealing with inorganic material that "just melts or runs down the wall."

Contending with the inorganic component must be a major part of the design for coal gasification systems, he said.

Baxter spoke about gasification during a panel discussion by the American Association for the Advancement of Science on Feb. 15. The symposium, "Coal Gasification: Myths, Challenges and Opportunities" took place during the AAAS annual meeting, held in Boston.

Baxter said until now, coal gasification always has been "more expensive than alternative ways of doing things. ... There's never been a business proposition for gasification."

But the energy business is changing. Production is much more expensive, more companies are competing fiercely for resources, and global warming concerns are prompting use of more expensive technology like carbon sequestration.

"For the first time," Baxter said, "gasification competes with — it's not clearly better than — all the other technologies, if you have to clean up the CO2."

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